MR

microcomputer design

Chapter Outline

1.	INTRODUCTION	*What a microcomputer is and how it is used. Focus of this book: practical microcomputer design, with examples and schematics.*
2.	THE 8008	*Brief introduction to microcomputers. 8008 architecture, block diagram. Timing signals. PCI, PCR, PCC, PCW cycles explained. Instructions listed in numerical order.*
3.	THE 8080	*General description. Comparisons with the 8008. 8080 instruction set, graphic format. 8080 software. Calculating memory access time, wait cycle timing. Preventing 8080 hang-up states.*
4.	MICROPROCESSOR COMPARISONS	*Microcomputers, millicomputers, and minicomputers. Brief comparisons: 8008/8080, 6800, 6500 series, 2650, F8, SC/MP. Sketch of 650X micro.*
5.	MAIN TIMING	*Clock circuits.* Efficient enable and strobe signal generation saves CPU chip count.* Master reset.* 8080 clock generation.*
6.	BUS STRUCTURE	*Introduction to bus structures. Latching logic; three-state devices. Advanced strobe techniques. Bus transceivers and bi-bus drivers. The 8008 data bus.*
7.	INPUT/OUTPUT INSTRUCTIONS	*I/O modes: 8008, 8080, 6800. 8008 I/O data transfer sequences. Generating input enable and output strobe signals.* Peripheral strobe decoding techniques.* 8080 I/O instructions.*
8.	INPUT DESIGN APPROACHES	*8008/8080 data bus input voltages. Multiplexers.* Bus-only input design.* Expanding 8008 input ports with conditional inputs.* Additional input ports addressed as memory.**
9.	OUTPUT TECHNIQUES	*Pulse outputs.* Conditional outputs.* Addressable latches.* Other latching outputs.* When an input is an output. 16–Bit Output Ports for the 8080.**
10.	COMBINED INPUT/OUTPUTS	*Combined input/output techniques: table lookups.* Sine table.* Byte-swapping.* Adding a UART to a microcomputer.**
11.	ADDING 8008 INSTRUCTIONS	*Normally unused 8008 instruction codes. Output any register.* One-byte PUSH-POP instruction.* Numbered JUMP, CALL, RETURN instructions.* One-byte WAIT instruction.**
12.	EXPANDING 8008 CAPABILITIES	*One-byte push-pop (LIFO) register.* Sixteen-byte LIFO.* A 32-byte FIFO register.**
13.	RANDOM ACCESS MEMORY	*Memory referencing, address conventions. The RAM-PAGE option: optimal design for small microcomputers.* The 256 x 4 RAM;* 1024 x 1 static RAM;* 4096 x 1 dynamic RAM.* Sketch of transparent dynamic RAM refresh system for 8008.**
14.	READ ONLY MEMORY	*Simple diode-programmable ROM for breadboarding, prototyping.* Field-programmable ROM (F/ROM), with programmer.* Reprogrammable PROMs. Comparison of types of ROM. ROMIN option allows flexible addressing of ROM in the microcomputer.**
15.	DIRECT MEMORY ACCESS	*Direct memory access defined. Sketch of system for 8080 microprocessor.**

** Schematic diagram included.*

Chapter Outline

16.	INTERRUPTS	*The initial interrupt. 8008 interrupt race. Simple interrupts. * Introduction to priority interrupt systems. * Interrupt request register. * Synchronization register. * Priority encoders, registers. * Interrupts being serviced registers. * Interrupts being serviced register. * Priority comparator. * Interrupt jam logic. * Numbered return instruction. * Using an addressable latch as an interrupt register. * Three-level priority interrupt system. * Full eight-level priority interrupt system. * Outline of daisy-chain interrupt system.*
17.	SAVING STATUS DURING INTERRUPTS	*Necessity for saving status: the PC stack; index registers; flags. Overview of status-saving techniques for 8008. Saving registers with hardware. * Latching up the flags. * Saving all four flags with hardware. * Four system examples, with software.*
18.	INTERNAL TIMERS	*How timers are used. Timer that causes interrupts. * Timer for input ports. * Interval timer clocks. * Precounters.*
19.	DIGITAL DISPLAYS	*Digital displays at microcomputer output ports. * Segment decoders. * Multiplexing. *
20.	PERIPHERAL INTERFACE DESIGN	*Systems considerations in designing a peripheral interface. Cost-effective modularity. An efficient bus structure for optimal peripheral interfacing. *
21.	KEYBOARDS	*Keyboard encoders. * FIFO data buffer. * Inputting to the microprocessor. * Implementing the REPEAT function with software. * Doing it with interrupts.*
22.	ANALOG INPUTS AND OUTPUTS	*An analog interface system for microcomputers: Input amplifiers. * One-channel A/D converter. * Sample/hold; track/hold. * Analog multiplexer. * Successive approximation A/D converter. * D/A converter. * Multiple analog outputs. * Analog range switching; software. *
23.	SOFTWARE TRICKS	*Clear the A register. Complement. Multiple precision ADD and SUBTRACT. Incrementing the H and L registers. Clear RAM. Indexed jump table. Indexed loops. Hard HALT instruction. PUSH all registers. 8080 PUSH/POP instructions.*
24.	TESTING	*Testing microprocessors. Simple test program. Designing for easy testing. Sixteen-channel oscilloscope display for any triggered-sweep 'scope. * Three-digit display to read data bus information in octal form, on the fly at normal system speed. * Reading T3 information only. * Stepping through instructions. * Using the READY line for testing. Using self-transfer instructions for testing.*
25.	MINIMAL MICROCOMPUTERS	*A nine-chip 8008 microcomputer, suitable for CPU testing and instruction. * Using the CC-DH register as a buffer. * A twenty-dollar microcomputer. * A seven-chip microcomputer with 2,048 bytes of ROM. *
26.	NINETEEN-CHIP MICROCOMPUTER	*Nineteen-chip microcomputer circuit with full ASCII keyboard, extra input port, 2,048 bytes of ROM, 256 bytes of RAM. *
471.	8080 CENTRAL PROCESSING UNIT	*Schematics and circuit description for CPU board of MIKE 3 system. Full capabilities of 8080 utilized. Power bus drivers, crystal-controlled clock, 3 interrupt levels (expandable), DMA capability. * *Supports 8008–compatible I/O instructions; bus structure compatible with 8008, 6800 processors.*
8008.	8008 DATA SHEET	*Reprint of manufacturer's 8008 data sheet (16 pp.).*
8080.	8080A DATA SHEET	*Reprint of manufacturer's 8080A data sheet (30 pp.).*

*Schematic diagram included.

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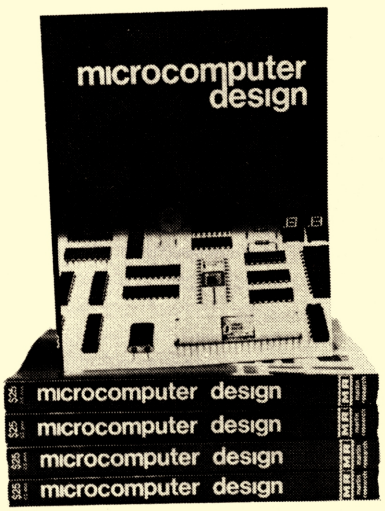

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MICROCOMPUTER DESIGN is well-suited for the engineer designing microprocessors into his company's products. Full schematics and circuit descriptions are provided for the 8080-based central processing unit of the *MIKE 3* microcomputer, in the *modular micro* series from Martin Research. Used as a textbook in many college courses, *MICROCOMPUTER DESIGN* is also a popular book with advanced home computer hobbyists.

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